REPORT RESUMES

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A VOLUNTARY PREKINDERGARTEN LANGUAGE DEVELOPMENT AND READING PROGRAM FOR THE ENTIRE FOUR-YEAR-OLD POPULATION OF A CITY (AN INVESTIGATION OF MACHINE-TAUGHT READING). FINAL REPORT.

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FOUR STUDIES CONDUCTED BY THE MOUNT VERNON PUBLIC SCHOOLS OVER A PERIOD OF FIVE SEMESTERS INVOLVED MACHINE-TEACHING READING TO 240 DISADVANTAGED PREKINDERGARTEN CHILDREN FROM THE CHILDREN'S CENTER AND THE CHILD DEVELOPMENT CENTER TO PREPARE THEM FOR MORE SUCCESSFUL KINDERGARTEN LEARNING THROUGH ACADEMICALLY-ORIENTED READINESS ACTIVITIES IN AN AMERICAN MONTESSORI CLASSROOM SETTING. THE CHILDREN'S CENTER SUBJECTS ATTENDED 1-HOUR SESSIONS WHILE THE CHILD DEVELOPMENT CENTER SUBJECTS ATTENDED 3-HOUR SESSIONS. EXPERIMENTAL GROUPS FROM BOTH CENTERS USED THE EDISON-RESPONSIVE- ENVIRONMENT TALKING TYPEWRITER AND THE STORY-TELLING-AUTOMATIC READING TUTOR MACHINES WITH PROGRAMS WHICH UTILIZED LINGUISTIC VOWEL-SOUNDS METHODS. THE CONTROL GROUPS USED THE SAME MACHINES BUT DID NOT RECEIVE PROGRAM TRAINING. RESULTS SHOWED SUPERIOR PERFORMANCE BY THE PROGRAM SUBJECTS, BUT THERE WERE NO SIGNIFICANT DIFFERENCES IN THE PERFORMANCE OF PROGRAM SUBJECTS USING DIFFERENT TEACHING MACHINES. THE 1-HOUR SESSION PROVED TO BE AS EFFECTIVE AS THE 3-HOUR SESSION. THESE RESULTS IMPLY THAT GREATER CONSIDERATION SHOULD BE GIVEN TO MORE ECONOMICAL PROGRAM SYSTEMS AND THAT CLASS TIME COULD BE REDUCED BY HALF WITHOUT LOSS IN LEARNING. (AUTHOR/NS)

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February 1968

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A VOLUNTARY PREKINDERGARTEN LANGUAGE DEVELOPMENT AND READING PROGRAM FOR THE ENTIRE FOUR-YEAR-OLD POPULATION OF A CITY

(An investigation of machine-taught reading)

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Mount Vernon, New York

February 1968

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U.S. DEPARTMENT OF
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Preface

The American educational community was apparently ripe for an attempt at automating instruction when an article by Skinner precipitated a general attitude revolution in favor of teaching machines. A major driving force behind this wave may have been our self-conscious recognition of the advance of technology in areas other than education. Because we were accustomed to see great advance in areas such as automation, electronics, physics, and areo- and space-dynamics we were somehow wrongly led to believe that teaching machines represented a similar advance in education. One still hears such statements "we are on the threshold of a technological revolution in education," then we proceed to act or think as though learning situations could be automated by machines just like mechanical operations are automated.

I should like to sound a warning against becoming too enamored of machines while paying insufficient attention to the program that goes on that machine. The most costly complex machine without a program is no more useful for teaching than an old discarded rusty tin can. Machines per se do not teach it is the program that teaches. The machine merely presents the program. For that matter, a teacher could be used to present the program. Even for teachers the program is most important. For example, the constant cry for smaller classes which is supposed to automatically improve instruction does not apparently agree with the evidence, which has shown repeatedly that a good teacher will do better with a large class than a poor teacher with a small class. It would be better to give a good teacher sixty students and the salary of four teachers, for example $5,000 x 4 = $20,000, than to give four poor teachers 15 students each and $5,000 each. Effectiveness probably depends most on how the teacher is "programmed". If it is true that the program is the important factor for both machines and teachers, then the technological revolution in education will not be brought about by attention to "hardware" but by attention to programs. One suspects that the unfulfilled expectations elicited by "we are on the threshold" are beginning to show signs of extinction through lack of reinforcement, and a major portion of the blame can be laid on over-enthusiasm about machines and relatively little emphasis on programs. While good programs presented by machines could conceiveably result in some of the unique benefits dreamed about, for example, wide distribution of a particularly good sequence - unless the vacuum in machine programs is soon filled there may be a backlash of anti-machine feeling. This criticism of the field of programed instruction is not intended to discourage development or research in programed instruction but to warn against premature exultation in a field which has not had spectacular educational results; to cause realistic evaluation of the present state of the art; and spur development toward achieving a state which could have some such looked for advantages.

Development of programs. Practically all courses of instruction existing today claim to be based on learning goals, but those goals may be only a test or text in popular use. Too little checking is done to see whether students will actually benefit from skills taught. A skill which will not be used in the future activities of the student is not based on a valid goal. Any school activity not resulting in greater competence relative to the student's future is wasted time. How much, then, in present curricula may be discarded with no appreciable future handicap? For example, to teach a student to drive a car, two methods can be used -- he can be asked to master all the books, articles, trade magazines and textbooks on automobiles and the physical principles involved in road traction, -- such as the difference between dry and wet roads at various temperatures, he can be shown how the steering mechanism is built, have him tear down and build again an entire automible, --which is fine if you want to make a mechanic out of him. Then he can be introduced to "real" driving. He can be shown how to put his foot on the brake, on the clutch, how to use the gear shift lever and accelerator and how to minutely perform any other operations involved, and asked to carefully perform each separate operation, pausing at each point to make sure it is mastered before introducing a new operation. Finally, the student would get to drive a car. Now if the student has nothing to do and if he is a very bright student, and sufficiently patient and "good" while being held back from actually driving a car, --the future goal of all this study-- he might get through the course in two years. Having completed the course we can assume he will perform adequately and can be certified a safe driver. Or can he? Or is a lot of effort wasted --in terms of the terminal goal --driving ability?

A second method is proposed. Ask the student to read the traffic laws of the state for one evening. Next day go to a pasture or a back country road, let the student sit on the driver's side, teacher on the other side, and without any explanation say "let's go." Let him do everything for himself. Be present only for answering questions if he asks or in case of emergency. Confine remarks to a few pointers on technique as you observe him. The only problem with this method is that the teacher tends to feel useless after about 15 minutes, and teachers must feel needed. This second method is at least implied by Gilbert (1962), Mechner (1967), and Mager (1964). What would happen if in our schools terminal behaviors were the goal rather that the text book, the achievement test, college entrance exam etc.? For this reason new machine programs should be based on original formulations and not on a present course or text.

Children versus adults as subjects. The majority of recognized laws and principles in learning psychology have been arrived at through experiments involving on the one hand animals such as the rat and the pigeon and on the other the adult human subject. Probably most subjects have been taken from college psychology classes. For the formulation of learning laws children between three and five seem to have been used relatively little. Programed instruction especially seems to have received its recent major impetus from investigation into the behavior of pigeons and rats first, and second college students with close attention to SR reinforcement theories. Little recognition is given the possibility that frames developed at the college level may contribute little understanding that is basic for use with the very young. If learning laws were valid they should be useful in designing new programs.

The fact is that at present in order to develope a good program the student must still be used primarily for direction. Just as Wilber and Orville Wright found all the contemporary laws of aerodynamics useless and proceeded to build a flying machine based on their own formulations, so present day programers will find present learning laws inadequate, though perhaps helpful if not taken too seriously.

Learning laws and programing prinicipies established from results of experiments using college students as subjects may further not generalize to 4-year-old children because of certain invalidating factors. College students may receive motivation to perform the experimental tasks from sources other than the experiment, (Bitzer 1965); and the fact that they may try to guess the intent of the experimenter and perform accordingly, (Dulany 1962). If the two factors mentioned above are missing in the self-teaching situation involving young children it is no wonder that extra help and encouragement is required when programs based on present formulations are given them. Motivation and intent as variables appear to have received relatively little attention, (Bender 1966, Gotkin and McSweeney 1967).

It may be more fruitful to use small children in definitive experiments in programed instruction because, while possessing all of the characteristic "human-ness" of adults, they do not attempt to anticipate the experimenter's intent or bring along extra-program motivation. If a program "works" where motivation is lacking and where the learner is not attempting to cooperate it certainly should work in most other situations. On the other hand the reverse generalization may not be valid. Part of the effort of the research embodied in this report is an attempt to gain insight into techniques of self-teaching programs.

This investigation began as a proposed dual investigation into Montessori techniques and the use of the ERE "talking typewriter. It ended as a mere general basic investigation of programmed machine-taught reading per se.

A pilot project using one ERE machine was run in the spring of 1965 and winter 1965-66 for the purpose of learning the use of the ERE machine and developing programs for that machine, prior to the inception of the main project in the fall of 1966. However, little progress was made in developing programs even to the end of 1966 due to certain unforseen difficulties, discussed in the next section.

The four studies making up this report were carried out over a period of five semesters. Within that time the project changed hands three times. By the end of the project none of the persons having had major initial responsibility were present. What began, therefore, as a demonstration project with primary emphasis on "American Montessori" technique and Moore's technique using the talking typewriter as an adjunct program, ended with primary emphasis on machine-progrased[1] instruction in reading. The shift in emphasis was dictated by the fact of changes in personnel, and by the original proposal. The originally stated intent was to demonstrate that a program consisting of language development and reading-readiness activities, part of it done by machine, would result in presumably some kind of gains for pre-kindergarten children. However, no actual language curriculum had been developed or specified prior to the beginning of the project, and therefore, needed to be developed before it could be used. It is obvious, therefore, that the project of necessity be a "development" project. Further, the machine programs did not exist at the beginning and little progress was made in both the Montessori language program and machine programs before the shift in personel was made. The little progress made on programs during the first four semesters of the project is not suprising when attention is called to the fact that the only programs used in the project which were considered successful, --used during the final semester, were based on a six-year prior investigation into automating reading instruction.

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[1] See note on page ix.

Progress made during the last semester of the project toward "adapting" this set of programs to the talking typewriter is reported in the third and particularly the fourth section of this report. It is clear then that the course pursued by the staff of the fifth and final semester was more or less dictated by the original proposal and the circumstances. It fell upon the final project staff to complete the research and this report.

Numerous people must be given credit for assistance in accomplishing the purposes of the project. Norman Eagle had a major part and is identified as co-author of section one. Special credit is due Edward Williams, prinicipal, for creating and maintaining an atmosphere so conducive to the cooperation of parents and children in the project and for community good-will. Appreciation is expressed to the eleven teachers, eight machine technicians and other personnel for their unstinting efforts and to the Board of Education for its cooperation during the final stage of this project.

The report follows a somewhat chronological order --the summary, an early history and critique of the original proposal, the Children's Center, experimental design solution, a controlled test of machine programs, and finally an overall comparison of the CC and CDC.

It is hoped that by calling attention to some of the problems encountered in this research and the particular method used to solve them, this report will serve to add at least a little to the area of programed instruction and particularly machine-teaching.

1. "Programed instruction" is sometimes regarded as the most scientific advance in Education. If true, then the field in general should adhere to principles making for most efficient learning. To make reading easier spellings should follow word pronounciation rules. Changing "programmed" to "programed" violates a well recognized spelling rule. If Programed Instruction desires to distinguish between its field and the more general "programmed", it should at least be consistently spelled "programd" and not "programed."

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Summary

This was an attempt to reach the four-year-old disadvantaged children of a city with activities calculated to prepare them for successful competition with their middle-class peers in school. The educational orientation of the staff was based on the assumption that for the disadvantaged child academically oriented readiness activities would be more beneficial than pointless play, --activities which were to be determined by an analysis of terminal tasks, and the learner's sophistication relative to the task. The setting in which skills were to be taught consisted of an "American Montessori" oriented classroom environment, and a teaching machine with particular attention to reading. Four-year-old children were recruited by various local announcements. Only those who applied at the center were included in the program. The study was divided into three phases; a three-semester pilot study involving 30 subjects in one Montessori classroom, also using one ERE (talking typewriter) teaching machine; a one-semester study in which the project was enlarged to 240 subjects in two centers, --the CC (Children's Center) with 90 subjects, and the CDC (Child Development Center) with 120 subjects, --and four ERE machines. Due to experiences encountered during these first four semesters the decision was made to tighten up the research aspect of the project. The experimental design was re-examined and changes made where necessary.

Beside the fact that the "Montessori" method in use at this location may have differed from that in use elsewhere, endangering generalizeability, in tightening up the experimental design it was

seen necessary to completely polarize the "traditional" and the American Montessori methods by specifying precisely the essential elements and activities which were to differentiate them and controlling the activities in the respective classrooms. Not one specifiable element was found which was claimed exclusively by either method. A further defect in such a design if feasible, would also confound the teacher effect with the method effect. Thus the "Montessori" - "traditional" comparison was abandoned and effort was concentrated on an investigation of machine-taught reading, using a non-confounding design. CC subjects then became a proving-ground for programs to be used in that investigation.

The CC (Children's Center)

Ninety four-year-old children were assigned to five groups of eighteen subjects each, each group attending the CC for one hour per day only. During this hour subjects were exposed to an "American Montessori" classroom and the ERE talking typewriter teaching machine. Three experimental groups, received Montessori; ERE programs; and a postsession, the postsession was eliminated during the final semester. Also during the final semester experimental subjects received first versions of programs used in the final controlled study. Two control groups, received the same treatment with the exception that they did not receive programs or the postsession. Due to the large number of dropouts, and exchanges between control and experimental groups the randomization assumption was violated. Remaining in the pool at the time of posttesting were 36 experimental subjects and 19 control subjects. Results show "program" subjects had higher mean scores than "no program" subjects on all three tests given: the Harrison-Stroud subtest (2), the Harrison-Stroud subtest (6), and the Vowel Test. Differences while significant on the vowel test only are in favor of machine subjects. The study is limited by the fact that the machine treatment was confounded with the postsession given at first but later eliminated, and otherwise unspecified treatment variables. Therefore the results need to be accepted with reservation.

Investigation into programed machine-taught reading became the focal point of the project during its fifth semester and final phase and the CC served as a proving ground for programs about to be tested. Four additional ERE machines and two START[1] machines were acquired. CDC subjects were used in this study. The study was designed to assess the effect of an "automated" system which emphasized intrinsic motivational devices in teaching reading-readiness using the ERE (talking typewriter) and the START (Story-Telling-Automatic-Reading-Tutor) teaching machines. The motivational devices were concerned particularly with the problem of how to secure a learner's attention and keep him at the learning task without outside interference, encouragement, or use of extrinsic rewards such as candy, grades, or adult inspired pressures. The programs changed the ERE "responsive environment", to a "teaching machine;" and the customary confounding postsession was eliminated. Controlled access to machines represented a change from the usual free-play use of START. A further confounding variable, present in many studies, --confounding teacher-class

[1] Note: The use of the START machine was supported by the Mt. Vernon Public Schools.

differences with experimental effects, were unconfounded by taking subjects out of their respective classrooms for treatment, and by having each class contribute equally to each condition. It was hypothesized that machine-treatment groups would be superior on criterion tests to no-machine groups; and that machines would not differ.

Eighty-nine four-year-old children, 80 percent disadvantaged, from the 120 CDC subjects (see table 2.1), were randomly assigned-- 53 to ERE; 19 to START; and 17 to Placebo-control groups. Subtests (2) and (6) of the Harrison-Stroud reading-readiness test and a "Vowel" test were administered as pretests and posttests. Subjects received five programs in 17 11-minute sessions. The t-test showed no significant differences between groups on the Harrison-Stroud test. A two-way analysis of variance, (treatments by classes), of vowel-test gain scores showed overall differences between groups (F = 5.20) significant beyond the .01 level. The t-test showed both machine groups superior to the control group (t= 3.03 for the ERE; and t= 3.79 for START), both significant beyond the .01 level for a two-tailed test. Mean gains on the vowel test were 2.1 items for the ERE group; 3.5 items for the START group; and -1.06 for the control group. Machine groups did not differ significantly.

The reasearch hypothesis that program subjects would be superior to no-program subjects was supported; and the hypothesis that machines would not differ was retained. Gains were achieved without the post-session. Effects on the vowel test were not observed on the more general standardized test. The motivational devices maintained interest for the duration of the experiment. Subjects' behavior on machines suggests the hypothesis that the feasibility of one program for the majority of subjects deserves investigation. Since the trend of differences was in favor of the more economical machine it is suggested that greater consideration should be given to developing programs for the more economical and easily available devices which are often given too little attention because they are eclipsed by the greater glamor of the complex and expensive computer.

1.0: Early History of the Project

Norman Eagle and Martin Bender

The philosophy and the orientation of the Mount Vernon Childrens Center was set forth in an undated and unsigned document prepared in anticipation of the organization of a new type of children's center, entitled: "The Childrens Center in Mount Vernon, New York -- A new educational institution in the nation." This position paper pointed to features which were to make the Childrens Center a new type of educational experience. Physically it was to resemble something familiar to the people of the community whom it was to serve. A store front operation seemed to be ideal. Situated close to the inner city it encouraged mothers to play a role as vital as the teachers in the learning process. They were to be partners with the teachers in an educational venture which would enable them first to learn the educational aspirations of their children and then actively help the children achieve them. The organizational aspects of the center were to be completely independent of the public school organization because of the apparant fear that institionalized education had not here-to-for been able to succeed with the inner city child. A modified and modernized version of the Montessori system was to be used in the program along with appropriate equipment and teaching tools. A pilot project based on these principles was started on a small scale in the Spring of 1965 with only 24 children and was conducted for five months. During the winter of 1965-66 the project was enlarged to 120 children who attended the Children's Center one hour per day. Also at this time at the Children's Center there was one ERE talking typewriter teaching machine. In April 1966 a proposal for external funding was submitted entitled, "A Voluntary Pre-Kindergarten Language Development and Reading Program For the Entire Four-Year-Old Population of a City" and in September, 1966 the Children's Center, along with an expanded program called The "Child Development Center" involving 120 children began operation.

An examination of the proposal itself does not give an indication of what kind of language development program was to be used. As far as the reading program was concerned references were made to the utilization of the ERE "Talking Typewriter" teaching machine but there was no indication of the program itself, that is, what was to be taught. It therefore should not be surprising that no concrete language curriculum was used although Montessori approaches were used. By November 1967 it became evident that systematic development of programs particularly for the ERE machine needed to be given highest priority. A team approach to program development was thus instituted. The team consisted of a programer, a reading consultant, the educational director of the project, and a research consultant. Conferences were held at weekly intervals in order to produce an overall approach to teaching of reading by the ERE machine using specific beginning programs. The programer was then expected to develop programs following recommendations of the committee. During the following week the committee then reviewed the effects of the programs in actual operation. It is probable that this method might have resulted in some effective programs if continued over a period of time. However it became evident that a specialist in programed learning and reading was required for most efficient productivity. Furthermore very soon thereafter the educational director of the program was lost to the project which tended to forestall any further development of the language development program.

Problems of automated instruction. Considerable difficulty was experienced with the operation of the machine. Breakdowns were numerous, resulting in many hours of down time and disruption of program scheduling, making it difficult to give children a specified number of exposures each week. Our experience shows that there was a higher percentage of down time at the beginning of the program but that this improved considerably as the year progressed. Another procedural element which violated a strict machine approach was a high degree of machine-technician instructional intervention. Technicians tended to use the intercom often to help the students through rough spots making difficult development of self-instructional programs.

Suseptibility to external pressure. One of the problems encountered in this operation, and which would tend to be encountered in any public school system, was the degree of external pressure, and lack of appreciation of the fact that this was a research project. Under such circumstances it is obvious that it was impossible for the research program to proceed as a program separate and distinct from administrative policy and questions and problems of the larger school system. This separation and independence is a necesaary prerequisite for legitimate research in a public school system.

The original proposal included in it's title "--For the Entire Population of a City." As will be seen the total number of subjects involved in the study was 240. First grade enrollment for the city in September 1966 was 982 and in September 1967-- 974. Thus, it is estimated, only approximately one-fourth of the children of the city were actually included in the study. The original intent of the project was more oriented toward demonstration than research. Therefore it was difficult to run the project as research. For the original project to have functioned as research would have required certain modifications. Research in education should be concerned with the solution of persistant problems in education and these problems tied to specific terminal goals. However, the original proposal, while having certain laudable goals described in global terms was lacking in prior specifically defined goals on the one hand, and on the other inadequate specification of paramaters and procedures. For example, the following are several verbatim abstracts from the original proposal:

"The program proposed has two educational facts:

1. "The pre-disposition toward school through an early successful learning experience."

"The pre-kindergarten setting would emphasize the following features:

3. The pre-kindergarten approach would be continous with the known expectations of kindergarten. It would initiate the children into social skills relevent for adjustment to kindergarten as well as language skills anticipated by kindergarten teachers as necessary."

"Objectives:

1. To demonstrate that a language development program for four-year-olds of one hour daily over a twelve

> month period can provide a common language experience for subsequant public school kindergarten and primary schooling, to stimulate children toward interest in writing and reading, and help those children desirous of writing and reading to begin to do so... etc. "

Notice that the descriptions and objectives are defined in such general terms that it would be difficult to initiate or repeat any consistent procedure, a first requirement of research. How is predisposition toward school measured? Or what are the "known expectations of kindergarten"? How is "interest in reading and writing" measured.

And a further abstract:

"Groupings

Group A:	Will participate in the one hour language development program and be exposed to the E.R.E.
Group B:	Will participate only in the Montessori oriented language development program but will not be exposed to the E.R.E. An experience similar to the E.R.E. though non-instructional in nature will be provided to anticipate any Hawthorne effect.
Group C:	Will participate only in Day Care recreational activities, not in either the language development or the E.R.E. programs. Special non-instructional activities will be devised to anticipate any Hawthorne effect.
Group D:	Will participate only in Day Care recreational.

From the approximately 280 children who applied for admission to the Child Development Center (Day Care + Education Center) but were rejected randomly because of lack of facilities, approximately 120 will be randomly assigned to four groups as follows:

E:	Will attend the Education Center one hour per day and participate in both language development and E.R.E. programs.
F:	Will attend the Education Center one hour per day but participate only in the language development program. The Hawthorne effect will be anticipated with the provision of an activity as in B.

G: Will attend the Education Center only for the 15-20 minute E.R.E. experience and a non-instructional 45 minute play period.

H: Will attend neither Day Care nor Educational Center program. In effect these will be "home" children. However, they will be administered criterion tests and will yield Baseline control data. Cooperation will be solicited from parents with a commitment to enroll the child in the summer Headstart program.

The (Group A) "one hour language development program" and (Group B) "Montessori oriented language development program" were probably intended to be identical. Assuming that educational goals and procedures had been adequately specified, groups A, B, C, and D, could have been the basis of an analysis of variance design. However, since each group is assigned to one teacher any teacher differences are confounded with treatment difference making results uninterpretable. (See pp.26-27,39-40 for suggestion toward overcoming this confounding difficulty).

Assuming again that each of the treatments were adequately specified, groups E, F, G, H, could serve as the basis for an analysis of variance. Furthermore, the teacher confounding variable is not present since all the groups come to the same teacher for one hour except for group H, which does not attend. In the actual execution of the project group G was ignored completely and there was much freedom in moving children from one group to another between groups H, F, and E, violating the random assignment assumption. The chief difficulty with the one hour program was that many parents felt it was not worthwhile to bring their children out for one hour only.

Summary

Research in a public school must be in charge of research personnel with adequate training. Such projects must be autononous and not subject to pressures of a non-research nature. Public schools tend not to realize that research requires extremely close supervision and direction. It appears to be difficult for one person to be engaged in normal school activities and at the same time in research.

2. The programs for a machine must receive highest priority, --there must either be adequate programs or a person capable of producing such programs. Characteristics of such a person are at present unspecified but might perhaps include a background in learning and a predisposition toward use of machines.

3. Cbjectives and Procedures of the research must be adequately specified.

2.0 Children's Center (CC)

Physical Facilities

The Children's Center was situated on the first floor of a remodeled three story residential house. At the entrance was a waiting room; next was the "Montessori" classroom; a hall, and last the "machine room" in which the four ERE machines were stationed.

Table 2.1

Number of Subjects and Groupings

Childrens Center (CC)						
Time	9:00	10:00	11:00	1:00	2:00	
N	18	18	18	18	18	
Total						90
Child Development Center (CDC)						
9:00 - 11:30						
Classroom		1	2	3	4	
N		15	15	15	15	
12:30 - 3:00						
Classroom						
N		15	15	15	15	
Total						120
Controls (non attending)						30
Grand Total						240

Subjects

Subjects were four years old or more but less than five by December 31, 1966, and were randomly selected from the total pool of 300 children. However, many of them dropped out of the one-hour program after parents found out they were assigned to the one-hour program. This resulted in a last minute scramble to obtain sufficient numbers of children to replace those dropping out. All late applicants were accepted and a number of control children were used to replace drop-outs from the experimental groups. The experimental groups could not therefore be considered a random selection. Replacements made at a relatively late date were not pretested. Fifty-five subjects, including replacements remained in the CC by the end of the year.

Procedure

Each hour on the hour (9, 10, 11, 1 and 2 o'clock), a group of 18 children arrived at the center and stayed for 55 minutes.

The Classroom had one "American Montessori" certified teacher, one "American Montessori" trainee and one teacher assistant. As the children came in, each child was guided to the area chosen for him at that particular time. The majority of activities in the classroom were carried out using small groups and individual instruction. Besides teaching children to answer in full sentences, there were activities involving the alphabet, numbers, counting, a minimum of singing, and some listening to stories. Reading readiness activities followed a linguistic approach. Since there was only one hour most of the time was spent in directed activity rather than in "play". At some time during the hour each child was taken out of the room to the talking typewriter.

The Machine Room had four ERE machines, a technician for each machine and a "programer." Children were taken out of the classroom to the machine room for a 10 - 20 minute machine session and a ten minute postsession conducted by the technician. The postsession consisted of drilling him on what he had just had on the machine. The nine and two o'clock groups (control) were allowed to " free-type" on the machine for 20 minutes but were not given the postsession. In the free-type mode the child could depress any key which resulted in a recorded voice, called the "key voice," naming the letter of the key. No other programs were given control subjects.

Initially all children, both control and experimental subjects, began with the free-type key-voice mode. The intention was to move experimental subjects from the free-type mode into individualized programs based on each subject's daily interest as rapidly as possible.

A number of subjects developed a method of finding the correct key quickly by using all fingers of both hands to touch and rapidly tap at random all of the keys without paying attention to program contingencies. The responses were thus mainly trial-and-error. Although a few subjects were able to match visually the proper key with a letter displayed on the slide, none could find a key if asked to find a key without the slide in response to the voice only.

In the middle of January, 1967 a change was made in procedures. The postsession was eliminated for all subjects. The key voice was turned off much of the time for the so-called "control group" subjects. A set of reading-readiness programs already in use were adapted to the ERE machine.

Initially several children showed hostile attitudes toward the new machine voice but this disappeared after a few sessions. Personnel attributed the hostility to a change from female to male voice. Subjects later appeared to prefer the male voice. This interpretation is supported by results of section (4) where there was no evidence of other than friendly reactions to the voice. The programs are more fully described also in section (4) of this report. The CC subjects now served as initial try-out for the programs being adapted to the ERE machine, programs which were later revised and used in the study reported in section (4). When no new programs were available as occassionally happened, current ones were re-run. Beyond this, what treatment the CC subjects received was unspecified. Any results must be accordingly interpreted.

Post testing. The Harrison-Stroud subtest (2) --word matching; the Harrison-Stroud subtest (6)--a verbal alphabet test; and the vowel test --testing knowledge of short vowel sounds, were administered as posttests in early June 1967. These tests are also more fully described in section (4) (p 38-39)

Results

Of the 90 children originally in the CC there remained at the end of the year 55 subjects available for posttesting. Table 2.2 presents the Means and Standard deviations of scores made on the Harrison-Stroud subtest (2), the Harrison-Stroud subtest (6) and the Vowel Test.

It was seen from table 2 when all no-program subjects (N=19) and all machine-program subjects (N=36) were compared, machine-program subjects had higher mean scores than no-program subjects on all three tests indicating superior performance of program subjects. The cause of the effect would have to be looked for in experiences encountered by subjects in: the machine and postsession treatment (first semester);

and experiences as a result of later being the proving ground for new programs. Differences, while consistently favoring the "machine" subjects (taken as a whole) were not significant for both Harrison-Stroud subtests (2) and (6) but the difference between groups on the vowel test was significant at the .05 level (t = 2.50), using a two-tailed test of significance and 53 degrees of freedom. No comparisons were made with the home controls which were not available for posttesting in June.

Table 2.2

Means and Standard Deviations of Posttest Scores of Children's Center Subjects

Groups by hour of attendance	Harrison-Stroud (2)		Harrison-Stroud (6)		Vowel Test		
	Mean	S. D.	Mean	S. D.	Mean	S. D.	N
ERE (program)							
10 - 11	14.7	6.8	24.1	13.6	20.4	5.2	13
11 - 12	14.7	1.5	28.4	10.5	21.9	3.6	10
1 - 2	18.0	7.0	29.9	11.7	23.4	3.1	13
Total	15.9	6.4	27.4	12.4	21.9	4.3	36
CONTROL (no-program)							
9 - 10	12.6	2.8	18.4	11.6	18.6	1.5	7
2 - 3	17.0	4.2	27.4	10.7	10.3	2.2	12
Total	15.4	4.3	24.1	11.9	19.7	2.2	19

Discussion

The Vowel Test consisted of specific learnings in the programs concerned which involved identifying vowel sounds in word context. While the differences between the combined Control groups and the combined experimental groups were significant only on the Vowel Test, the trent was consistent in favor of program subjects. This does indeed suggest that the differences were due to effects of the programs, since on the more general test differences were slight but non-significant. A limiting factor is the confounding of effects of the post-session given subjects during first semester with effects of programs given later. Thus, while the results consistently favored machine subjects they could be due partly to the postsession and should be accepted with reservation.

Summary: Ninety four-year-old children were assigned to five equal groups of eighteen subjects each, each class attending the Children's Center for one hour per day only. During this hour subjects were exposed to an "American" Montessori classroom; the (ERE) teaching machine; and a post-machine session. Two control groups received the Montessori treatment but did not receive machine programs or a post-session. Three experimental groups received programs and a postsession first semester, and programs-only second semester. Results show "no-program" subjects had lower mean scores than "program" subjects on all three tests given: the Harrison-Stroud subtest (2), the Harrison-Stroud subtest (6), and the Vowel Test. Differences were significant only on the vowel test. The machine treatment is confounded, with the postsession and otherwise unspecified first-semester treatment variables. Differences in favor of machine-program subjects while consistent, could be due partly to the postsession.

3.0 The Problem of Experimental Design

The combined operation consisting of the Children's Center (90 children) and the Child Development Center (180 children) was run in separate, though adjacent buildings, and was partially supported in a mixed manner by Title I, New York State Education Department, and Title IV OE. The division consisting of the CC was the subject of the previous section of this report. The total operation including the CC and CDC, though supported by several funding agencies, was run as an integrated unit. This report, therefore includes a few facets in addition to those strictly of OE support because they are not entirely separable.

Physical facilities: The Child Development Center was on the first floor of a renovated high school building. Rooms were approximately 24 ft. square with high ceilings and an old appearance. Six classrooms each accommodated fifteen children at a time, one class a.m. and one p.m.

Classroom background activities varied from "American Montessori" to modified "American Montessori" to "traditional." Although two non-Montessori teachers attempted to follow an "American Montessori" method, with Montessori equipment, the extent to which they achieved this goal is open to question.

"Montessori" versus "traditional" methods was one dimension of the study. The "American Montessori" method used in the one class differed in at least one aspect from that in use in at least a few other places - the midwest for example. The manner of teaching included the usual Montessori "three-step" procedure i.e - demonstration - selection - recall - , but what is thought by some the most important overall philosophy of the Montessori method was missing, i.e leading the child toward independence of inquiry with the teacher gradually receding into the background. Thus results would not be interpretable unless the "Montessori" method used were adequately specified.

It was seen that the proposed comparisons of the original proposal were Montessori versus no-Montessori and machine versus no-machine. A little serious examination of just what happens when one tries to differentiate between Montessori and traditional methods will reveal that in order to make a comparison using the four classes in this project, or for that matter using any number of classes, the variables existing in the classroom would need to be highly specified. In an ordinary classroom so many variables exist that it is doubtful whether it is possible to achieve any degree of specification. On the other hand, in order to make valid research comparisons, it is absolutely necessary to do so because results might be caused by or confounded with any number of unspecified, or even if specified, uncontrolled variables. Notice the careful attention researchers in psychological research take to ensure that alternative hypotheses cannot be used to explain results. Unless each variable is specified and carefully controlled, the results cannot be clear. In a classroom setting where treatments are administered by non-researchers, or even where two highly prescribed and isolated tasks are taught in a classroom by competent researchers, it is extremely difficult if not impossible to fully specify, and control all of the variables, though essential. Thus, any comparison of two classroom "methods" must always be questioned.

This section was an attempt to specify the Montessori and traditional methods and is a record of the outcome and the reason for the direction the research took from this point on.

There follows first a description of the Montessori approach as given by the CDC personnel, then an attempt at polarization and last the results of the attempt at polarization.

The "American" Montessori Approach as given by CC and CDC Teachers and the educational director.

a) never let child risk failure - have him move at his own speed.
b) environment - structured on three part lesson plan, as an example.
c) all materials must be replaced by child where obtained. Puzzels, etc., all carried in a structured way. Originally shown as group demonstration. Chairs carried, pushed in, etc., all structured. Ground rules firmly established so that chkld knows reason for rule - misinformation never permitted
d) balance of teacher-pupil relationship - child making match with other child; "budy" system.
e) noise level at minimum-respect for autonomous work building up the level of concentration of child in terms of expanded time element.

Group and individual lessons should be extremely flexible.

The teacher must at all times be moving in a way as a model for child behavior. Consistency of performance--trust in the intrinsic capability of the child-- (this we truly believe!)--completely structured in terms of material placement. From this point of view the child's potential is limitless according to individual ability. The teacher is the "non-teacher" taking cue from child whenever possible. We are convinced that the child's potential is merely a reflexation of the potential exhibited by the teacher's positive sanctions. Negative sanctions at a minimum established by ground rules. Information elicited in a way so that child never risks the failure syndrome; Our goal is not just learning, it is a love of learning we are trying to engender, and hopefully we feel we are succeeding. Our parents and our children and our teachers work as a team toward this end. We feel the proof is "in the pudding" -- the recipe can always be improved - and we are constantly aware of new techniques -- but never sacrificing consistency of purpose.

The children come in, hang-up their coats by themselves, go to the shelves and choose some work. Each works individually, returning his material when he is finished and replacing it with some other material of his choice. The teacher circulates at this time to reinforce specific learnings involved in the materials.

While half of the group is at the bathroom, the teacher takes the other half (nine or less) for a lesson at flannel board or other bulletin board in classroom. Each child participates by turn e.g, each child flashes light on several letters of the alphabet on bulletin board while the group names the letters.

The Montessori Approach: an attempt at polarization.[1]

In the Montessori approach activities are designed so as to highlight or abstract the essential elements or principles to be learned; thus each activity tends to have a single educational purpose and the activity is focused so as to minimize interference with this purpose. In the enrichment approach, activities are generally designed so as to accomplish multiple purposes, to provide opportunities for a variety of different learnings; activities tend to be less structured and focused, so as to allow different children to learn different things from the same activity.

These contrasts are clearly seen in the divergent treatment of block play in the two approaches. In the Montessori approach a particular block activity may be intended to teach the ordering of objects according to cross-sectional area. In this case, the blocks will be of standard length, color and shape, varying only in cross-section; and the child will be guided to use the blocks only in a way that involves ordering them according to increasing cross-sectional magnitudes. In a typical enrichment program, on the other hand, children may play with wood blocks differing in a number of dimensions and different children may be pursuing quite different purposes. One child may, in fact, be ordering them according to cross-sectional area, but another may be ordering them according to length, and others will not be ordering them at all but will be experimenting with balance, with the construction of various forms, or with imaginative play in which the blocks represent trucks or houses.

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1 The report is indebted to Carl Bereiter for aid in the formulation of this statement

The same contrasts, however, may be applied to language programs, even though the beginning Montessori method has not traditionally included a language program. The Montessori language approach would be derived from an analysis of language concepts and skills: what must a child learn in order to employ a given grammatical form meaningfully; what must he learn in order to understand the nature of opposites, of verbal analogies, of inclusive class names, etc.? Then structured activities would be devised, each of which brought into prominence one of these critical elements of learning. The enrichment approach, on the other hand, would seek out those types of experiences that would stimulate language behavior generally and which would provide diverse opportunities for the development of expressive and receptive language, for the learning of many different concepts and linguistic forms. Role-playing, puppet play, use of telephone conversation, and diversified language games, story-telling, story-listening, field trips and their discussion, picture discussions, etc. would fit the requirements of the enrichment approach.

For the Montessori approach, it is intended to make use of the analyses of language tasks and some of the activities presented by Bereiter and Engelmann in their book, Teaching Disadvantaged Children in the Preschool, and their booklet, Language Learning Activities for Disadvantaged Children. Although their specific procedures are not the kind that would ordinarily be associated with Montessori methods, their analysis of language skills into specific learning requirements and the focussing of each activity upon a specific learning objective are consistent with the distinguishing features of the Montessori approach noted above. The rationale for the curriculum, in other words, is compatible with the Montessori approach; implementing it within the context of Montessori education, however, will require the development of activities that provide for more individualization of learning activity and for the integration of the language learning activities with the other learning activities making up a Montessori program.

In order that a true distinction between the Montessori and "enriched" conventional classes will be maintained the following procedure will be followed. Two leading Montessori specialist consultants will be asked to list all possible activities in a pre-kindergarten program. They will then be asked to specify behaviorally the treatment of this activity from a Montessori viewpoint and from a conventional viewpoint. (See example of block usage above).

Results of attempt to polarize Montessori and traditional methods

In attempting to polarize or isolate the differences between Montessori and traditional methods it soon became apparent after consulting numerous persons that it likely would prove impossible to obtain any great degree of consensus. Both the traditional teachers and the Montessori teachers refused to be categorized and claimed components of both poles as their own. A typical reaction was "but this is my method -- I pick the best from all of the methods and incorporate them into my teaching."

A question of experimental design

The attempt to polarize the Montessori and traditional methods indicates clearly the confounding presence of unspecified, uncontrolled variables in classroom-situational experiments where the classroom is the unit of comparison. In an ordinary classroom so many things go on that it is not possible to specify all that goes on. Thus, when there are twenty teachers in a study, (all of them likely to be unsophisticated in research methods) and twenty similar teachers who are supposedly using another method, numerous alternative hypotheses can be given since the factor of primary interest may be present along with many other unspecified classroom factors. The experimental factor is confounded with either teacher effect or any of a host of other uncontrolled factors. Such was the case in the original design comparing two Montessori classes and two traditional classes (an N of four -- too small for convincing results) so that Montessori versus "enrichment"treatments were confounded with teacher and class differences.

In that design it would be necessary to rigorously specify, polarize and control all activities and balance or eliminate all but the essential elements in the dicotomy, but such specification was shown to be hardly possible, and even if it were, would so alter the basic composition of the classroom that it would no longer be considered the "method."

To overcome the problem the following design was used. Each class contributed equal numbers of subjects to each treatment condition. Individual subjects were taken out of the classroom for treatment. In this way each class represented a complete replication of the experiment so that teacher or class differences were randomized and could be controlled in the analysis, and teacher-class differences were not confounded with treatment effects. In this design it was not necessary to specify rigorously or control classroom activities. It now actually became desireable to introduce some variations in order to increase generalizeability of results and interpretations. The following section reports a study based on this design.

4.0 Effect of Machine-taught Beginning Reading on Pre-kindergarten Children

Teaching machines have been hailed by some as the revolutionary and long-awaited panacea for all educational ills, though little evidence exists to support such a view. It appears some are mistaking a wished-for event for an actual happening. The evidence in favor of teaching machines or programed instruction over teacher instruction is slim indeed. What evidence there is, is often confounded with teacher or class differences; with pre-sessions, post-sessions, . Hawthorne effects, etc. Differences between experimental and control groups (if indeed there is an experimental design at all) are often slight or non-existent. Where substantial differences are reported they may be attributed to alternative hypotheses. There is a need for straight-forward rigorously controlled testing of systems (Klausmeir and Goodwin, 1966) which will permit interpretation of results and replication by others instead of relying on blown-up claims of advertisers.

There are certain aspects of the field of educational technology which are relatively satisfactory when properly used: language labs, movie films, closed circuit television, workbooks, textbooks and story books. The area which is not satisfactory, is that segment of technology which periodically claims to have made instruction automatic. one sees advertisements by machine manufacturers of "automated" systems for instruction and programed booklets purportedly giving the ability to provide unmonitored self-instruction. However, the actual state of affairs at present is that no instructional system exists which can be classed as completely automatic. Some machines could be said to be automatic with respect to certain limited mechanical functions but they generally lack adequately developed or proven programs. Quite often the system is merely an adjunct program consisting of tape recorders, projectors, and all sorts of paraphernalia requiring an expert or full-time attendant to operate the system. As for programed booklets the situation is similar. Alleged self-teaching programs actually require the presence of a teacher to start off the child, or to urge the child to continue the program (Roth, 1963). While the use of such partially automated systems is not being criticized, claiming more for them than can be demonstrated is being criticized.

"Automated" instruction as here defined should require no external assistance or encouragement at any stage of learning. In this respect, ordinary story books are about the only automated instructional devices in existence at present. Of all commercially available programs it would be difficult to identify one which achieves "automation."

Completely automated instruction would yield certain advantages. Teachers could become instruction specialists, instead of administrators Once an effective tested sequence is found, it can be repeated an indefinite number of times. Certain topics which tend to be evaded by elementary teachers (Bereiter, 1967) could find their way into prekindergarten and kindergarten classes.

The present study was designed to test the effect of a set of programs purporting to achieve a degree of automation with respect to reading-readiness activities accomplished chiefly by use of programed motivational devices.

The programs. "We-Are-The-Vowels" is a series of twenty programs designed to teach pre-school children a measure of reading ability. They were designed to be self-teaching and automatic or semi-automatic, depending on the machine they are used with. A book version could allow parents or teachers to take place of the machine. Instructional rationale is based on high-interest programing sufficient to sustain self-initiated use of the system.

A linguistic approach is used. The *linguistic* method was developed to overcome the basic weakness of the *whole-word* method which in its pure form ignores spelling rules, thereby imposing too large a memory burden on the young learner. The *phonic* method teaches word-rules which the *whole-word* method does not but in the *phonic* method there is the assumption that separate sounds can be put together to form words (illustrated by the familiar "Kuh ah tuh -- put them together and they make cat"). In the *linguistic* method on the other hand families of words are used to teach sounds and spelling rules.

While the present system is a linguistic approach, it differs from present linguistic methods in that: vowels are taught first and consonants secondarily; learning of sounds is emphasized instead of merely learning to distinguish printed letters or associating symbols to "already-learned sounds," adheres to the principles of self-teaching; and utilizes story programing for the purpose of motivating the learner. It is expected that the stories used will be found to have many additional cultural and intellectual benefits to the student.

The Vowels Versus Consonants. Present linguistic methods derive from Bloomfield and Barnhardt's (1961) "Let's Read". Word families are taught with the short a in them, but the a is retained too long before moving on to the next vowel, until the a is overlearned, violating principles established by Harlow (1959). In the "We-Are-The-Vowels" programs all five short vowels are introduced at the beginning, while consonants are taught incidentally since they are consistently spelled and therefore easier.

Necessity of learning sounds not just symbols. Some authors of reading materials appear to assume that the learner simply learns associations between printed symbols and sounds, sounds which he has learned previously (Freis, 1964.) But there is a possibility that learners may not previously have learned to discriminate certain sounds required for decoding printed words and required before an association can be established between a sound and the symbol. While present linquistic methods appear to be effective in teaching reading it is believed that children learn inadvertently these needed discriminations during unspecified auxiliary activities provided by the systems and so the process escapes notice. In the present system learning of sounds is deliberately taught.

Embedding all teaching materials intrinsically in stories is the single most effective motivational device utilized and makes the "self-teaching" concept workable, (although the addition of certaih games has additional effect).

Machine delivery of stories makes it possible to eliminate the requirement of a controlled vocabulary, long a standard. The commonly used methods restrict the vocabulary to what is sometimes called a "first grade" vocabulary; or to consistently spelled words; or in the experience approach, to words the child uses. This restriction is necessary for every formal method (except the present one) because in every method the child must read each word in the text. In the early stages of learning to read the child can read only a few words. It will be a long time before he can read the full range of vocabulary he is able to understand. For a long time reading will be hard work and the only satisfaction he can derive from it, if any, is the satisfaction of mastering something which is apparently valued by adults. If he values reading at this time that is why (Bereiter 1967). Children who somehow fail to detect this adult-inspired "value" are denied even this motivation, and these are the children who will need to learn reading skills most.

In this system the machine could be considered as a tool enabling the child to "read" the first story and every story thereafter entirely by himself. The child is held responsible only for the words he can read, but, because the machine fills in and tells him the words he can't read he is exposed to the full range of vocabulary that he is capable of understanding from the very first program. In fact, a few "big" words are thrown in, the meaning of which he can derive from the context, in order to stretch his vocabulary -- a happening which all present methods (except the home-on-daddy's-knee-method) avoid like a hornets' nest. The interesting thing is that children learn these "big" words as easily as any others according to observations made while using the present programs. The I.T.A. overcomes this restriction perhaps a little earlier in the course of learning to read than some methods, that is, once the 44 letter code of the I.T.A. is broken the child presumably can read any word he can pronounce, but there is still a long period in which he can not read interesting stories because of his little skill. The resulting frustration mentioned above may be a factor in developing distaste for reading, present in many poor readers or non-readers.

Pictures are used sparingly. Bender (1965) has shown that pictures did not have a facilitating effect and in fact were detrimental in early stages of learning a sight vocabulary. It was hypothesized that the decrement was due to the distracting effects of pictures Since no published contrary evidence was found it appeared advisable to use pictures with discretion only to illustrate a specific point, or to increase motivation.

Program contingencies. The first five programs used in this study taught the following items specifically: the sounds of "a, i, u" separately and in words; and - "an in un at it ut".

The Machines

The ERE machine (Edison-Responsive-Environment) or the "Talking Typewriter" was the result of the work of O. K. Moore. He used an electric typewriter to teach children to read. In the first stage, the child was allowed to explore the keyboard at will. He could type any letter he wanted to. Each letter he typed was named by an attendant standing by. As soon as the child had explored the keyboard for a sufficient length of time the attendant switched to a second stage in which the child was required to type letters called out by the attendant. By means of a hand held electric switch the keyboard was locked until a correct response was made. Eventually the child was expected to progress to taking dictation and copying sentences. Each session lasted about 20 minutes, or less if the child decided to terminate it. The machine session was followed by what could be termed a "post session" in which one pupil and one teacher spent a considerable time together in additional practice with letters, writing, etc. The post session was an important integral part of the method.

The "Talking Typewriter" or ERE machine is an attempt to computer-automate Moore's concept of a "responsive environment". The machine performs many operations automatically but an attendant is required to correlate the projector and magnetic card to initiate the sequence and to monitor the child's activities.

The machine consists essentially of four displays: a typewriter, a slide projector with a ten inch screen, an exhibitor card with pointer, a sound track for the card, and a sound tract for each typewriter key. The four separate displays are controlled and sequenced by computer-read magnetic codes previously placed on the back of the exhibitor card by the attendant. The machine is approximately a four-foot cube and weighs perhaps 500 pounds. The typewriter keyboard side of the machine extends into a sound-proofed booth where the learner sits to operate the machine. The machine requires an attendant, and is semi-automatic.

The START (story-telling-automatic-reading-tutor) machine was built to implement the "We-Are-The-Vowels" programs in a free-play home setting. The machine was approximately 2 X 2 feet and weighed perhaps 20 pounds. The machine was activated when the child sat on the machine's seat. It presented an integrated audio-visual program by the reeling-unreeling of a scroll behind a lighted window. It was capable of having simultaneously a changing visual display and a running auditory commentary. In operation, the program stopped at important points and called for a response from the child which was made by touching a specific part of the window. A correct response resulted in forward movement of the program. An incorrect response turned the display-window light off, and made the machine inoperative. In that case, in order to proceed, the child had to depress a button on the machine (for from 0-2 seconds) before the program started up again. The latter feature was designed to discourage trial-and-error responding.

A reverse lever permitted the child to replay any part of the program or to return it to the beginning. If the child anticipated a correct response the machine merely clicked and moved on. Depressing two response panels simultaneously turned the light off in the window same as for an incorrect response. In the center of the display window was a spot slightly larger than word size that was more brightly lighted. The sound of each printed word was synchronized with the entry of its printed counterpart into that lighted spot. This in itself was considered to have some teaching effect. The audio-visual tapes were an integral unit and could not become unsynchronized. No attendent was required except to determine order of subjects running.

Summary

Moore's original concept was that of a "responsive environment" in which the child controlled the environment and the environment simply responded to him. By having an attendant order the machine's response modes individually for each child, the child was supposed to acquire by discovery the ability to read. Apparently a number of children did learn to read but there were several serious defects in the design of the investigation. His subjects were probably of above average intelligence, but most important, all of the effects observed could have been due to the post session which was conducted on a one-to-one basis with a teacher. Without proper control subjects and elimination of the post-session, it can not be said that the machine alone did the teaching.

In the present study, there were two important modifications in the use of the ERE machine: the post-session was eliminated; and randomly assigned placebo controls received the same treatment except for the machine treatment. Furthermore, a basic difference existed between Moore's approach and the programs used in this study which had the effect of changing the ERE machine from a so-called "responsive environment" to a teaching machine. This was predicated on the assumption that the programmer knows better than the child what he should learn (Bereiter, 1966). All experimental subjects were exposed to the same "linear" programs.

There was also a difference between the free-play setting in which the START unit was intended to be used, where the machine was always waiting for him -- all he had to do was to sit on the seat and operate the system ---and the present experiment in which subjects used the START machine only when the researcher called them. What difference this would make was unknown. It is likely that the variation in amount of time spent by students would be greater in the free-play situation, particularly in a school setting. Overall learning affected by the amount of time spent would show greater variance in post-test scores.

The present study was designed to test the effects of the "We-Are-The-Vowels" system used with two teaching machines. The main questions asked of the research, either formally or informally were the following:

1. What hypotheses are suggested by observing children in the experiment?
2. What happens when a program used with one machine is adapted for use on another machine?
3. What effects on specific and general reading tests can be observed?
4. Can ERE machine effects be observed on criterion tests when "post-sessions" are eliminated (most uses of the ERE machine include a post session).
5. What hypotheses can be made for possible comparisons of characteristics unique to each machine.

The research hypotheses were:

1. Both machine group means will be significantly superior to the control group on the Vowel achievement test, with no observable difference between groups on the Harrison-Stroud general reading readiness test.
2. There will be no difference between ERE and START group means either on the Vowel or Harrison-Stroud tests, in line with the contention that "programs" not machines are paramount.

Subjects

One-hundred children attending eight classes at the Child Development Center, of whom approximately 80% were in categories 5, 6, 7 of the Warner Scale, and 20% in categories 1 through 4 were in the pool. At the time of the experiment (May 1 - June 10) subjects were between 4:4 to 5:4 years old. All subjects had attended Pre-k classes since September, 1966. Children with severe handicaps, chronic absenteeism, or who were untestable were not included. This population could be considered somewhat above average for a disadvantaged population because of these selection factors. The internal validity of the experimental design prevents this factor from biasing results however, but it does tend to reduce generalizability to more disadvantaged populations.

Background classroom activities were of two types; Montessori classes modified to include language development training of a somewhat more directed type than one would expect for a Montessori classroom; and classes characterized by an "enrichment" program. Attendance at school during the year would be expected to make subjects relatively less timid in a new situation or when first introduced to the machines.

Tests

Subtests (2) and (6) of the Harrison-Stroud Reading Readiness Test were used. Subtest (2) was a 30 item word matching test. Subtest (6) was a 42 item letter recognition test.

Subtest (2) - word matching. A word was printed in a small box and four similar words were printed in a long box at the right. The child was asked to match the word in the small box with one of the words in the long box.

Subtest (6) - letter recognition. All the letters of the alphabet, in both upper and lower case, were printed on white cardboard. The letters were presented to the child by an examiner who pointed to each letter and asked the child to name the letter.

The Vowel Test was a 40 item test. Five items were matching items in which the child was asked "which letter looks like this one?"; there were five letter identification items and twenty word identification items which required recognition of the short vowel sound used in the word. While the entire 40 item test was administered, ten items not used in the programs were not used in scoring, resulting in a 30 item test.

Procedure

The Harrison-Stroud Reading readiness subtests and the Vowel achievement tests were administered toward the end of April, 1967. Children who were untestable because of absenteeism or handicap were excluded from the population pool. One-hundred subjects from the eight classrooms were in the final pool.

Each class contributed equally to each experimental group, making each class, within limits, a replication of the experiment, and tending to make differences between classes or teachers a random variable, thus eliminating the confounding of these effects with treatment effects. That is, where a few classes as a whole are assigned to treatments, one cannot tell whether effects are due to differences between teachers or to treatment effects, a problem overcome by the present design.

Subjects were assigned as follows: Sixty subjects received the Vowel programs on the ERE machines, twenty subjects received the Vowel programs on the START machines, and twenty subjects received no machine experience or programs but had stories, not necessarily the same as on programs, read to them by a teacher assistant.

The ERE method for introducing a child to the ERE machine is contained in Appendix A. Programs were presented in the following order: 0 0 0 0 1 0 1 1 2 1 0 2 3 4 2 3 4 5. "0" indicates free-type session, an integral aspect of these ERE programs. Subjects were given one trial each day or once through one program of about 10 minutes. Records were kept of amount of time spent by subjects, number of strokes, and other behavioral manifestations.

The START method followed closely that outlined in appendix A. Programs were presented (one each day) in the following order: 1 1 1 1 1 2 2 1 2 3 1 2 3 4 1 2 3 4 5 3. Time and behavior records were kept as described for the ERE machine. In addition to the records kept for the ERE group, a record of incorrect responses was kept.

START program numbers correspond to the same numbers on ERE programs except for "0" - a free-type session, for which there was no START counterpart.

Children in the control group were taken to a small quiet room by an assistant, where one or two stories (not necessarily those on machine programs), were read to the children, pictures displayed and discussions held.

All subjects were post-tested with the same tests used as pretests by the same persons giving the pre-tests. Children in the three conditions were randomly distributed among the testers.

Results

A total of 89 subjects remained in the final analysis: 53 subjects in the ERE group, 19 subjects in the START group and 17 in the control group out of 60-20-20 respectively. Eleven subjects were lost due to absence for the post-test. Attrition is assumed random.

Table 4.1 presents the results of the analysis of variance for the pretest-posttest gain scores on the Vowel test, which showed an F value of 5.20, significant at the .01 level indicating overall significant differences between means.

A t-test for the difference between means of the ERE and control group ($t = 3.03$) is significant well beyond the .01 level for a two-tailed test with 67 degrees of freedom indicating

Table 4.1

Analysis of variance of gain scores (pretest to posttest) on the Vowel test

Source	SS	df	MS	F
Treatments	198.9973	2	99.4986	5.20**
Blocks (classes)	66.1258	7	9.4465	
Within	1512.3825	79	19.1441	

** F of 4.92 significant at the .01 level.

superiority of the ERE group over the control group. A t-test for the difference between the means of the START group and the control group (t=3.79) is significant well beyond the .01 level of significance for a two-tailed test with 34 degrees of freedom indicating superiority of the START group over the control group. A t-test for the difference between the means of the ERE and START groups (t=1.34) is not significant at the .05 level of significance though the trend (Table 4.2) is that the START group had a higher mean gain than the ERE group.

The differences here reported are not apparently due to differences in basic ability if one may judge from both the Vowel and the Harrison-Stroud pretest scores as seen in Table 4.2. Mean gains on the Harrison-Stroud test for the ERE group was 3.92 items; for the START group 5.06 items and for the control group 6.47 items

Table 4.2

Means and Standard Deviations of Scores on Tests

	Pretest		Posttest		Difference	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
ERE (n=53)						
Harrison-Stroud (2)	16.42	6.93	17.00	7.37	.56	5.11
Harrison-Stroud (6)	18.13	13.83	21.47	13.61	3.34	5.90
Total	34.55	19.45	38.47	19.30	3.92	7.93
Vowel Test	20.57	4.29	22.62	3.92	2.06**	1.55
START (n=19)						
Harrison-Stroud (2)	16.33	6.71	17.11	7.02	.78	5.55
Harrison-Stroud (6)	18.22	11.88	22.50	12.68	4.28	5.41
Total	34.55	16.64	39.61	19.26	5.06	9.08
Vowel Test	19.47	3.84	23.00	3.67	3.53**	3.79
Control (n=17)						
Harrison-Stroud (2)	16.06	5.58	18.76	4.17	2.70	5.50
Harrison-Stroud (6)	20.00	13.20	23.76	11.62	3.76	6.82
Total	36.06	17.08	42.52	14.07	6.47	6.94
Vowel Test	22.29	4.42	21.23	3.59	-1.06**	3.25

Harrison-Stroud (2) -- 30 items

Harrison-Stroud (6) -- 42 items

Vowel Test -- 30 items

**Significant at .01 level --machine groups compared with control group.

for the 72-item test. The t-test showed that the trend of differences in favor of the control group over the ERE and START groups on the Harrison-Stroud pretest to posttest gains did not approach significance. It could be said the loss by control groups on the Vowel test was due to relatively higher scores on the pretest, an interpretation which does not agree with results of the Harrison-Stroud test scores which show relatively higher, but non-significant gains made by the control group. The loss by the Control group on Vowel pretest-posttest gains was similar to that observed in another study (Bender, 1966) where subjects were retested before substantial machine exposure had been given. It appears reasonable to believe differences in favor of machine groups are genuine.

From Table 4.3 it can be seen that START subjects spent slightly less time per day than ERE subjects but that the total time spent by START subjects during the experiment was slightly more (6.1 min.).

Table 4.3

Mean Number of Daily Exposures and Mean Total Time Spent per Subject

	ERE	START
Mean total time per subject	183.90	190.01
Mean number of days exposure per subject	15.8	18.47
Mean time spent per day (trial) per subject	11.62	10.29

ERE subjects missed slightly more days than START subjects which could be attributed to less interest or to the more frequent break-downs of the ERE machine. The slightly longer time spent per program may be a reflection of the fact that there was a delay on the ERE machine of as high as two seconds after the machine finished giving an instruction, before the subject could depress the proper key, and vice versa, resulting in slightly more time required to get the same amount of material through the ERE machine than the START machine.

A factor that could have slightly affected the total amount of time was the fact that six girls and two boys showed anxiety reactions apparently to the general feeling of being left alone in the ERE booth. Since children could leave if they wanted to several terminated a few sessions early, resulting in less time. Apparent timidity disappeared entirely by the tenth day, however. No subjects displayed anxiety reactions to the START machine which was not enclosed in a booth.

Table 4.4

Average time spent on each program

	0	1	2	3	4	5
START	----	12.02	8.12	9.95	10.27	12.11
ERE	8.79	14.58	11.95	12.65	10.00	14.13

Table 4.4 shows that START subjects began with program 1 while ERE subjects began with a free-random-type mode or "no-program" --standard practice on ERE.

The programs called for verbal replies by children. Responses to requests by the machines for verbal responses was quite varied. Most of the children answered the questions, nodded heads or talked back to the machine. The amount of verbal responses appeared approximately the same for both machines. Children were generally quite friendly to the machine voice and tended to treat it as personal to themselves.

The ERE machine can be programmed to repeat an auditory stimulus at intervals until the subject types a response. Sometimes subjects told the voice to be quiet. At other points in the program, where the machine had not been programmed to repeat the auditory stimulus, subjects sometime forgot the last word spoken by the machine. They were thus encouraged to engage in trial-and-error search since there was no way for the subject to have the machine repeat the last phrase. The START subjects had a reverse lever and were able to replay any such section at will although few subjects learned this contingency in the short time of the experiment.

The educational significance of the treatments is best seen if one notices that in slightly more than three hours distributed practice (18 ten-minute sessions) subjects were able to score an average gain of 2.1 items for the ERE group and 3.5 items for the START group. While it is difficult to make meaningful comparisons between a teacher and the machines as to teaching effectiveness, it is believed that the gains in this study compare favorably with what a teacher would have achieved in similar time. Before the experiment it was believed that machines would be relatively ineffective and that it was premature to compare a teacher with the experimental groups. Future investigations, therefore, should include a teacher-taught control if possible.

Discussion

A limitation on the study is the extent to which the results can be generalized to other populations. Subjects were a "selected underprivileged" population by virtue of the fact that only those whose parents were sufficiently interested initially, and, after seven months to voluntarily bring them to the center, were included. They had seven months of what was essentially a regular school kindergarten experience.

Another limitation is the fact that the criterion test used was specific to the subject-matter taught on the programs. This was done deliberately to augment observation of program effects. On the other hand, the skills tested for --the short vowel sounds-- are usually considered of second-grade-level difficulty rather than the preschool level of the subjects of this study. Long-range effects of the treatments on reading ability must await assessment by other studies.

Another apparent limitation is that the project director may have had an interest in seeing START show up superior to the ERE machine (though both programs were authored by him). But subjects were taken to the machine and tests were administered by others. Further, while researchers are often highly biased in that they expect or desire certain outcomes, who is sufficiently unbiased to pass judgment on the bias of another researcher? Productive research is not conducted by elimination of opinion and bias but by rigorous control, adequate specification of procedures and reproducibility of results. So also the present study must await replication by other investigators.

A difference between means of the machine and control groups was hypothesized, but the difference between machine groups was not expected. The ERE machine, while prone to break down, had better sound quality than the START machine and thus was expected to result in better sound discrimination training if a difference would be observed. The trend noted is in the opposite direction.

The postsession, it is argued, confounds the results of some studies using the ERE machine. In this study of the ERE machine there was no postsession. It is not known whether there are any other formal evaluation studies involving the ERE machine which did not include a postsession, showing similar gains --with perhaps one exception (Gotkin and McSweeney 1967)-- if theirs is considered evaluational. Effects observed could not be the result of effect of teacher in the classroom since an equal effect could be assumed on the control group.

Among teaching machine enthusiasts there is a tendency to think in terms of tailoring instruction to each individual student. Machines do permit individual progress and give each student equal attention but the reality of individualized instruction may be overrated if by "individualiz is meant a unique sequence for each student. Any person who has produced just one "good" sequence, particularly for age five and below, is well aware of the effort involved --plotting the layout, the countless revisions until finally a program may be created which produces the desired behavior. It is at least a full-time job to produce satisfactory programs in one small area for just one child. How anyone can claim "individual" programs for twenty students is difficult to see. The term "individualized instruction" sounds impressive but usually when programers get down to the job of producing "individual" programs they find it isn't so easy and the programing flounders. A more practical route is proposed: It is believed that there are sufficient commonalities among learners to permit the use of one good sequence for most children and for the remainder, a few supplementary and parallel programs. (The present programs were designed to vary according to individual needs primarily by the number of times the student is exposed to each reel.) In other words, there is more in which all children are alike than in which they differ. In support of this hypothesis several informal observations are offered.

First, the behavior of the 72 machine subjects in this study indicated that subjects tended to follow similar sequences of patterns of behavior when introduced to the machines, --varying mainly in the duration of each stage. For example, when introduced to the ERE machine children might at first sit and quietly type on the keys for a period of time ranging for from two to ten minutes. This was the first stage. The second stage might begin by an abrupt cessation of typing. The subject now began to explore the environment --trying to look out of the one-way glass, looking under the machine, trying to take it apart or test its capabilities. The objective of future revisions of these programs should be reduction or elimination of stage two by having sufficient motivators in the program which are intrinsic to the desired learnings. It should be noted that in this study once children were introduced to the machine they were left alone, a major difference from the classroom and perhaps a difference from the majority of investigations into programed instruction, giving the subject freedom to engage in behavior not generally permitted and therefore not observable in the classroom. If the subject was not disturbed at this time he would eventually get on with the third stage and settle into the programing sequence. If he was corrected at this point and told to get on with the job, he might very well freeze at stage two, particularly if he happened to have more than the usual amount of exploratory tendencies. In the classroom such a learner might not be given freedom to explore, freeze at stage two and become a "dicipline" case.

Second, in the course of observing subjects on new sequences for the purpose of improving subsequent revisions the programer himself developed the feeling that "when you've seen three subjects on a sequence you've seen them all."

If these observations are correct, (and they are a type of learning), it tends to suggest that researchers should investigate the possibility of one program for most learners with re-runs of frames on which errors were made. Perhaps the chief difference between learners is the point in a sequence, on a line, or continum of knowledge he happens to be. The chief contribution machines then, could make toward individualized instruction, would be that of giving each learner equal and full attention, to allow freedom to stop, start, explore, and test hypotheses, and to enable a teacher to have each of her students at the appropriate point on a continum of learning, or perhaps to permit different numbers of exposures to the same program and different frame sequences on the same program.

While the one machine used in this study was very expensive, and the other of insignificant cost the two machines apparently resulted (within the limits of this study) in practically equivalent psychological effects when defined according to the tests given. Transfer of the programs from the low-cost machine to the high cost machine did not result in improvement. It could be argued of course that had programs, developed for the high-cost machine, been adapted for use on the low cost machine there would have been a decrement. But when one examines the basic mechanical parameters involved and their relation to psychological parameters it is reasonable to assume little difference in probable learning outcome between the two machines when the same programs are used. Both had a visual and an auditory display. The one machine allowed the student to take dictation on a typewriter keyboard, and the other was capable of a changing auditory and visual display simultaneously so that the advantages of each would probably wash out. The outcome was what one would expect if indeed it is the program rather than the machine which determines a system's effectiveness.

Motivation appears to be a major variable in a free-play machin situation. In this case subject interest was maintained and in fact it appeared that interest increased. Children appeared to learn to follow the story plot, to listen to sounds and instructions.

It was seen that the total instructional time amounted to about three hours. A single three-hour session might result in a similar score if the child were tested immediately following the session, but he would probably forget most of it in a day or two. The gains observed in this study, however, could be expected to be relatively stable since the three hours was spread out over five weeks.

Use of teachers versus machines. If one assumes that a teacher under similar conditions might have had about the same effect to that of the machines used in this study (which appears to be a reasonable assumption), then one can begin to make some rough comparisons of the relative cost of teachers versus machines. Note that the two machines used in this study can not replace a teacher since the subject-matter was of very limited extent when compared to what a teacher can give. At present, the subject matter machines can handle, is highly proscribed and there is no evidence that even in that limited area machines are more effective than good teachers. While machines are not as flexible as teachers they have the advantage that once a good sequence is found, perhaps imitating an exceptionally good teacher, it can be reproduced exactly within mechanical and electrical capabilities an indefinite number of times. Furthermore, machine systems (or programs), will be improved in the future. In any event only if one is interested in the specific subject matter taught by the particular programs used on those machines (such as reading instruction in pre-kindergarten and kindergarten classes) does a comparison of cost become valid. It all boils down to what is the most economical method to teach a particular set of skills. For the limited set of skills concerned in this study, or, unless the number of good programs approaches that of a teacher, a machine would need to cost a fraction that of a teacher to be profitable. However, we look forward to the improvement of programs.

Summary

The present study was designed to assess the effect of an "automated" system which emphasized "intrinsic" motivational devices in teaching reading-readiness using the ERE (talking typewriter) and the START (Story-Telling-Automatic-Reading-Tutor) teaching machines. The motivational devices were concerned particularly with the problem of securing the learner's attention and keep him at the learning task without outside interference, encouragement or use of extrinsic rewards such as candy, or adult-inspired pressures. The programs changed the ERE "responsive environment", to a "teaching machine"; and the customary confounding post-session was eliminated. Controlled access to machines represented a change from the usual free-play use of START. A further variable, confounded in many studies, that of teacher-class differences and experimental effects, were unconfounded by taking subjects out of their respective classrooms for treatment, and by having each class contribute equally to each condition. It was hypothesized that machine-treatment groups would be superior on criterion tests to no-machine groups and that machines would not differ.

Eighty-nine four-year-old children, (86 percent disadvantaged), were randomly assigned - 53 to ERE; 19 to START; and 17 to Placebo-control groups. Subtests (2) and (6) of the Harrison-Stroud reading-readiness test and a "Vowel" test were administered as pretests and posttests. Subjects received five programs in 17 11-minute sessions. The t-test showed no significant differences between groups on the Harrison-Stroud test. A two-way analysis of variance, (treatments by classes), of vowel - test gain scores showed overall differences between groups (F = 5.20) significant beyond the .01 level. The t-test showed both machine groups superior to the control group (t = 3.03 for ERE; and t = 3.79 for START), both significant beyond the .01 level for a two-tailed test. Mean gains on the vowel test were 2.1 items for the ERE group; and 3.5 items for the START group; and -1.06 of the Control group. Machine groups did not differ significantly. The research hypothesis that program subjects would be superior to no-program subjects was supported; and the hypothesis that machines would not differ was retained. Gains were achieved without the postsession. Effects on the vowel test were not observed on the more general standardized test. The motivational devices maintained interest for the duration of the experiment. Subjects' behavior on machines suggests the hypothesis that the feasibility of one program for the majority of subjects deserves investigation. The trend of differences in favor of the more economical machine suggests that economical and easily available devices deserve greater consideration. Such devices appear to be suffering relative neglect, perhaps because of the attention attracted by the glamor of "computerized instruction."

5.0 Combined Analysis of CC and CDC Subjects

Children in the CC were exposed to the ERE machine and "American Montessori" treatment first semester; and trial Vowel programs second semester. Children in the CDC were in either a "Montessori" classroom or a "Traditional" classroom and received machine experience as shown in section 4.0. Included in this combined analysis are the 55 subjects (both experimental and control) of section 2.0, and the 89 subjects of section 4.0. Table 5.1 shows the posttest scores made by the 55 CC and 89 CDC subjects on the Harrison-Stroud subtest (2), the Harrison-Stroud subtest (6), and the Vowel Test. The 19 control subjects from CC and 17 control subjects from CDC are included.

Table 5.1

Means and Standard Deviations of Scores on the Harrison-Stroud and Vowel Posttests

	Harrison-Stroud 2		Harrison-Stroud 6		Vowel Test		N
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
CC	15.7	5.8	26.3	12.3	21.1	3.9	55
CDC	18.1	6.8	23.8	13.7	21.5	8.1	89

CDC children had higher mean scores on the Harrison-Stroud subtest (2) (matching of words) and the Vowel test (discrimination of vowel sounds). On the Harrison-Stroud subtest (6) (alphabet naming) the Children's

Center subjects had higher mean scores than the CDC children. None of the differences were significant.

Since the Harrison-Stroud is a standardized test an estimate can be made of caparative educational development. It will be seen from Table 5.2 that when the mean scores of subjects on the Harrison-Stroud subtests (2) (visual word matching) and (6) (alphabet naming) are compared with standardized scores made on the same tests by students entering first grade, subjects of this study rank from the 61st to the 99th percentile on the two tests given.

Table 5.2

Mean scores on Harrison-Stroud test and corresponding percentile rank when compared with students entering first grade

	Harrison-Stroud 2		Harrison-Stroud 6	
	Mean	Percentile rank	Mean	Percentile rank
CC	15.7	82nd	26.3	67th
CDC	18.1	99th	23.8	61st

It will be seen from Table 5.2 that CC subjects ranked at the 82nd, and CDC subjects at the 99 percentile on letter-word discrimination. CC subjects ranked at the 67th and CDC subjects at the 61st percentile point on knowledge of the alphabet.

Notice that these children, after one year of the described pre-kindergarten training were thus defined according to the Harrison-Stroud subtests (2) and (6) as ready for first grade formal reading instruction one year ahead of schedule. Of children making such scores the Harrison-Stroud manual says:

"The pupil having such percentile scores (60 or above) should be placed with the group of pupils who require no special instruction and any kind of specific skills tested other than that which will follow the regular program of reading instruction. Pupils having such scores will probably become a rapid learning group in reading."

Whether or not these children would have rated 60 or above in the other subtests is not known since all of the subtests were not given, but it is reasonable to suppose that they would have so favorably compared since training emphasized auditory discrimination, a major component of the other subtests. Thus, according to Harrison-Stroud subtests (2) and (6) these children were on the average quite ready to enter first grade reading at the time they would ordinarly enter kindergarten. There was no evidence whatsoever that any behavior problems developed as a result of this early exposure and training. On the contrary, if parents' and teachers' comments have any validity then the opposite seems to have occurred.

It should be noted that the CC subjects, who attended for one hour only, compared favorably with CDC subjects who attended the three-hour program --according to the three tests given (Table 5.1). It appears, therefore, that the one-hour program was as effective as the three-hour program. This could have important implications for education --that time could be cut in less than half without learning decrement.Here lies a possible solution to the problem of "crowded schools." One-hour programs should be further explored.

Table 5.3 shows a rank order of items on the Harrison-Stroud subtest (6) for the 144 subjects used in this combined analysis. "A" ranked first and small "q" last in number of subjects getting the item correct. This was true for each subgroup as well as for the combined groups. The information was used in the construction of a test beginning with easy items and ordering subsequent items in order of increasing difficulty. Letter and word discrimination tests may yet prove to be the best "reading readiness" tests.

Table 5.3

Subtest (6) items ranked by number of subjects naming them correctly

Rank	Item	Times Correct	Rank	Item	Times correct
1	A	142	22	J	87
2	B	130	23	Z	86
3	o	130	24	m	84
4	E	110	25	e	82
5	R	107	26	w	80
6	D	106	27	y	77
7	s	103	28	f	77
8	L	102	29	p	76
9	N	100	30	a	75
10	c	98	31	v	74
11	F	97	32	u	70
12	M	97	33	j	67
13	T	97	34	n	66
14	G	96	35	r	65
15	H	96	36	b	46
16	I	95	37	d	45
17	i	94	38	h	45
18	k	92	39	l	34
19	Q	91	40	t	30
20	x	89	41	g	28
21	U	88	42	q	14

Summary

Fifty-five four-year-old disadvantaged children were exposed to a one-hour "American Montessori" and machine-programed-instruction in reading and 89 disadvantaged subjects were exposed to a three-hour program of similar content for one school year. Subtests (2 and 6) of the Harrison-Stroud reading readiness test and a "vowel" test were given as posttests. Results show subjects could be considered "ready" to begin reading (as defined by the Harrison-Stroud test), one full year ahead of schedule and with apparently "healthful" psychological effects on children. Further, the one-hour program was as effective as the three-hour program. Implications are that early instruction is feasible and time in school could be reduced by at least one half without learning decrement.

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Appendix A

How to introduce children to the ERE and the START machines using the We-Are-The-Vowels programs

It is important to introduce the child exactly right the first time in order to establish correct behavior patterns. Go to the room. Get the eye of the teacher. Ask her to let you have the child the first several times only. Then you communicate directly with the child, you persuade him, not the teacher. From the moment the teacher gives permission for you to take the child she loses jurisdiction over the child till you bring him back. After the first few times catch the eye of the child and beckon with your finger or say "Johnny, your turn." Don't ask him whether he wants to come. Suppose he says "No." Assume the child is most eager to come. On the way to the machine room build up the child's natural curiosity.

Special instructions for the ERE machine. When you get to the room say "See those toys --see this door --look in there --wanna see it?" If child goes into the booth and starts typing let him, then leave him alone. If he doesn't, ask him what will happen if he pushes one of the buttons. If this doesn't get him started, you sit on the chair and type for a while. Don't ask him to push the keys until he shows he wants to do it very much. Then you say "you touch that one." Don't ask him -- just let him.

The moment he touches a key you react in great exuberance "yea" and clap your hands in keeping with the child's and your surprise and pleasure at what "that machine" did. Then say "I'm going to let you do it for a while. When you hear the "bong" then that's all. OK? I'll come back later." Then stay out of the booth and off the intercom. Let him alone.

Special START instructions. When you get to the room say "see those toys." Make sure the program was previously rewound, ready to start at the beginning, with the reverse lever in neutral position. When he sits down simply push lever forward and say "listen to what it tells you." At the first response stop, if he doesn't touch the response window and make it go, slowly reach over and make the correct response for him -- no more. If he makes an incorrect response resulting in machine shut-off, just say "hold that black button down," that's all. Go away and let him alone.

Overall instructions.

Never say: "Come on, try it."

Never say: "Don't do it that way."

Never say: "That's wrong." --take "No" out of your vocabulary.

If he asks "this one?" say "what do you think?" or "you do it." At first the child will be attentive to the program but he may soon begin looking about to see what else the machine will do. The system is designed to be automatic so stay out of it. It's his business what he does with it and when. If you want to frustrate him or defeat the system's self-teaching characteristics then correct him or say "don't do it that way." You may say "you're a good boy (girl), or "you're doing fine" --if in fact he is.

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TITLE

A Voluntary Pre-kindergarten Language Development and Reading Program for the Entire Four-year-old Population of a City.

(An Investigation of Machine-taught Reading)

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INSTITUTION (SOURCE)

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RETRIEVAL TERMS

1. Pre-kindergarten Reading
2. Machine-teaching
3. Computer assisted instruction
4. Disadvantaged children in the pre-school
5. Montessori versus traditional methods
6. Research in the Public Schools

IDENTIFIERS

1. Edison Responsive Environment System
2. START (Story-Telling-Automatic-Reading-Tutor)

ABSTRACT

This project operated by the Mount Vernon Public Schools involved machine-teaching reading to 240 disadvantaged pre-kindergarten children in classroom settings which varied from a localized "American Montessori" approach using more directed teaching than usual, and "traditional" approaches influenced by proximity to that "Montessori" approach. Subjects attended either a one-hour or a three-hour session. The ERE (Edison-Responsive-Environment), and the START (Story-Telling-Automatic-Reading-Tutor) machines, were used with programs employing a high-interest, linguistic vowel-sounds method. Although originally planned, a comparison between "Montessori" and "traditional" approaches was dropped because it was not possible to polarize and specify the two methods satisfactorily, nor separate teacher-class differences from experimental effects. The machine-taught program no-program comparison became the focal point of the research. Results showed superior performance for program subjects, significant at the .01 level. Mean difference between subjects using the same program but different machines was nonsignificant, though the trend was in favor of the more economical machine. Educational effect for the limited subject-matter appeared informally to be comparable to expected live teacher effect. Informal observations were in line with the "one-program-for-most-learners" notion. Performance of one-hour subjects was equal to three-hour subjects. Implications are that greater consideration should be given more economical programed systems, and, time in school could be reduced by half without learning decrement.